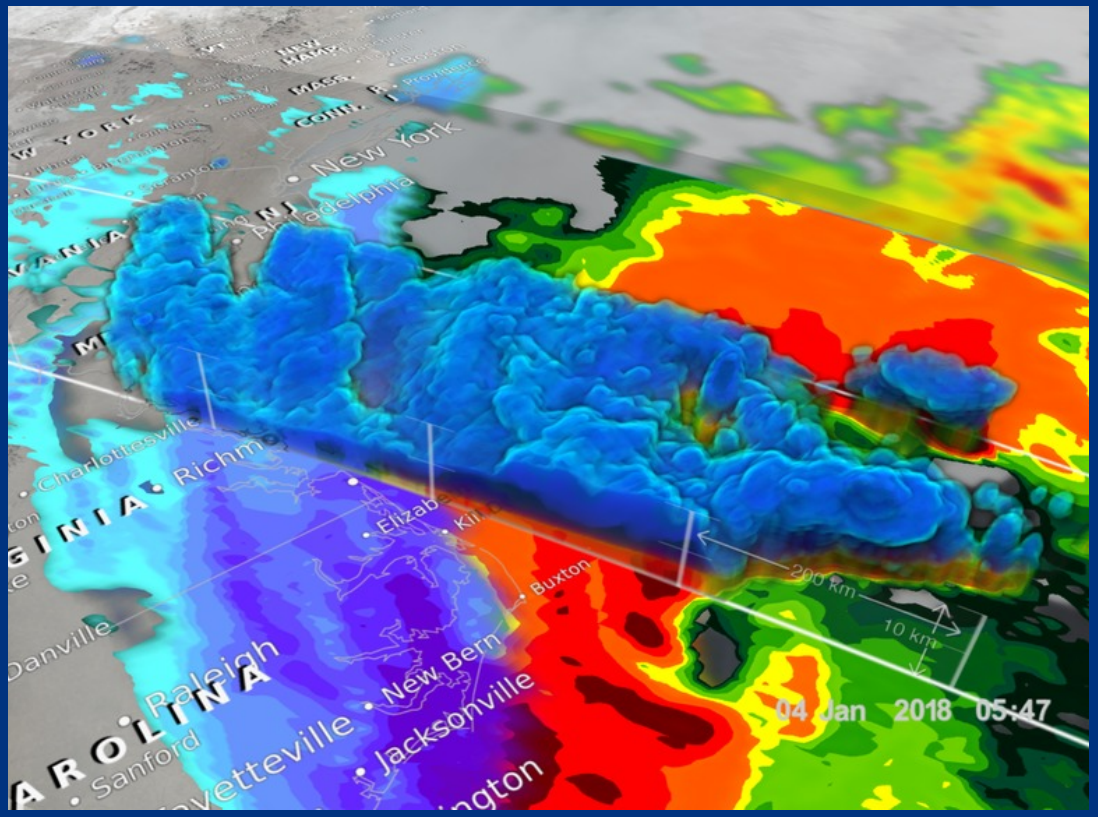
GPM Science Status



GPM Sees East Coast Snow Storm on January 3, 2018

Scott Braun
GPM Project Scientist

NASA Goddard Space Flight Center

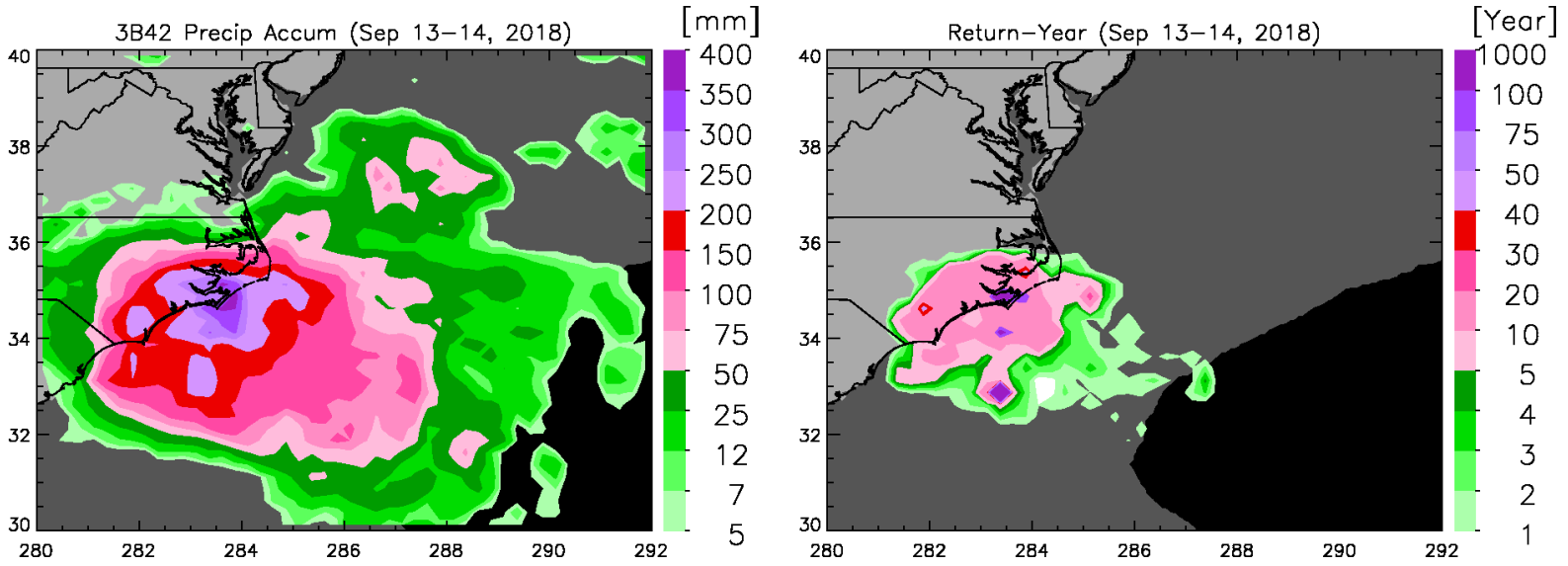
PMM Science Team Meeting
October 8-12, 2018
Phoenix, AZ

www.nasa.gov/gpm
Twitter: NASARain
Facebook: NASARain

Outline

- Spacecraft/instrument status
- Algorithms and related analysis
- Science highlights
- Related mission news

Hurricane Florence Rainfall Accumulation And Average Return Interval

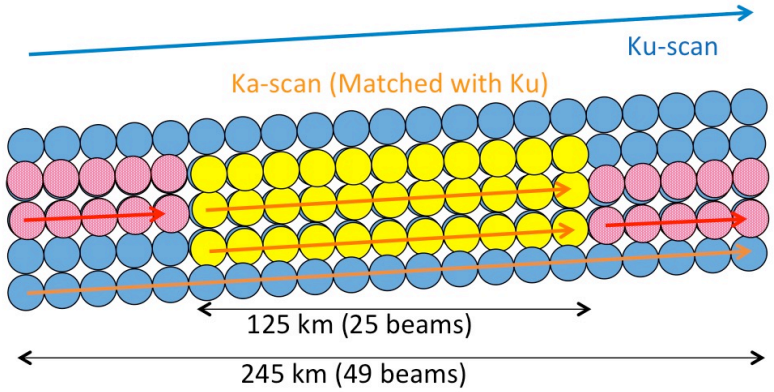


Courtesy of Yaping Zhou

Spacecraft and Instrument Status

Spacecraft and instrument status: All systems are fully functional

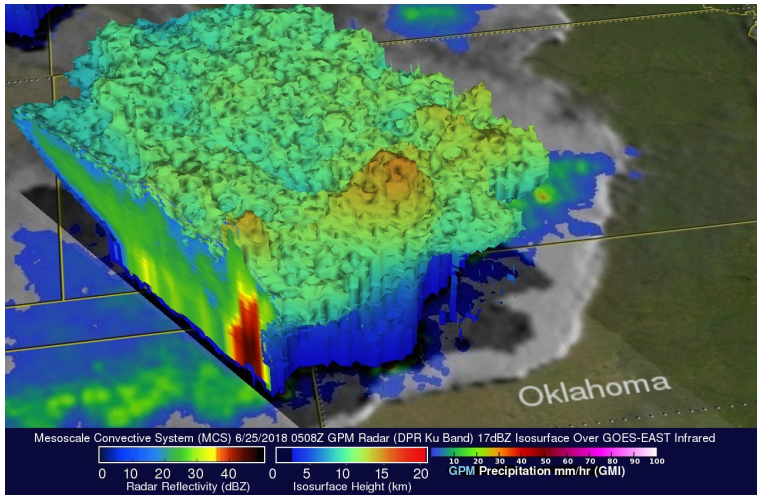
DPR switched to full scan on 5/21/18
Algorithms still need to be updated to process full scan for Ka



Fuel Predictions (w/controlled re-entry)

Prediction	Plus/ Early	Mean/ Nominal	Minus /Late
June-2015	05/2029	11/2039	06/2043
Nov-2015	03/2027	03/2035	08/2039
May-2016	06/2032	04/2037	10/2047
Nov-2016	08/2029	01/2035	10/2038
May-2017	12/2034	05/2036	02/2037
Nov-2017	08/2027	07/2032	08/2035
May-2018	**03/2033**	**05/2035**	**03/2037**

Fuel is unlikely to be the limiting factor

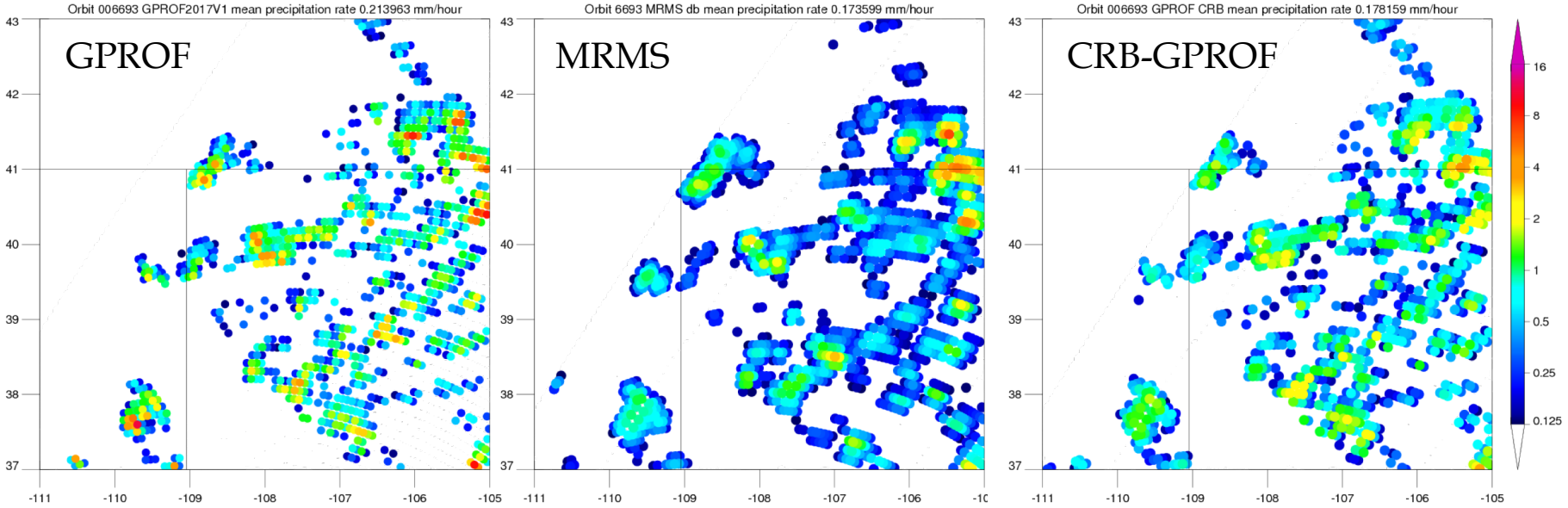


Algorithm Highlights

- GPM
  - GPM GMI/DPR/CMB/constellation began processing V05 by 5/2017
  - IMERG V05 began 11/2017
  - DPR L2/L3 and CMB: Began reprocessing V06 by 10/2018
  - IMERG V06 expected to begin processing January 1, 2019
- TRMM
  - GPROF: TRMM TMI L2/L3 reprocessed to V8 (V05) by 4/2018 and partner satellites by 2/2018
  - PR L2/L3: Reprocessed to V8 (V06) by 7/2018
  - Combined: Reprocessed to V8 (V06) expected by 11/2018
  - IMERG V06 expected to begin reprocessing no earlier than January 1, 2019
- New product—Colorado River Basin GPROF products

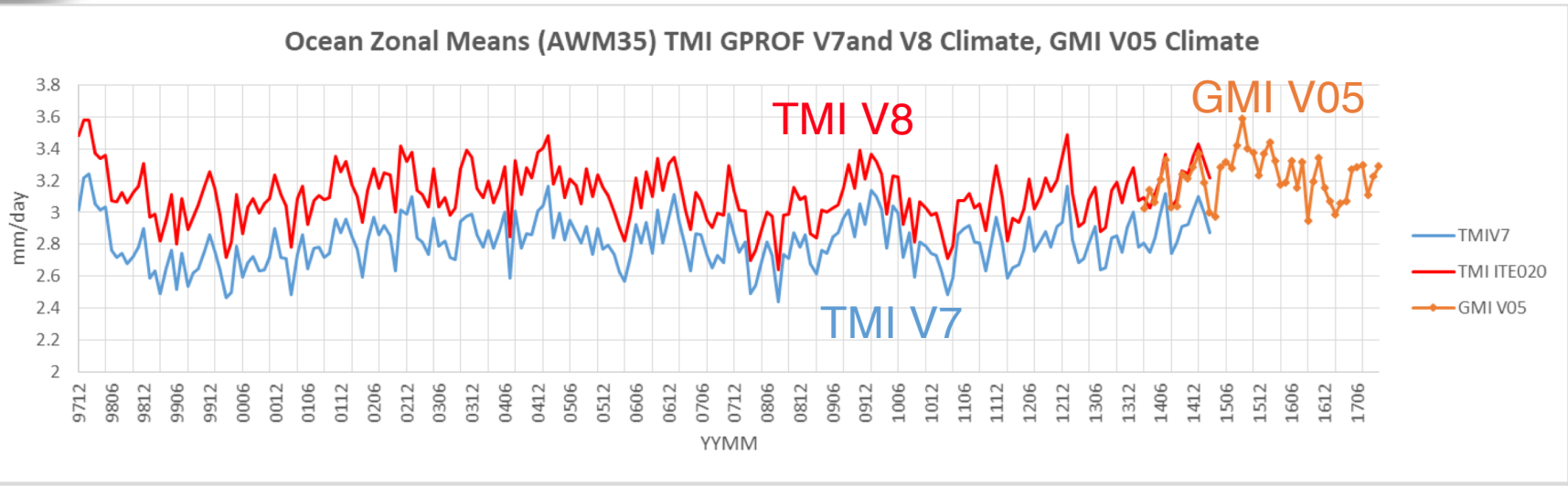
Colorado River Basin GPROF Description

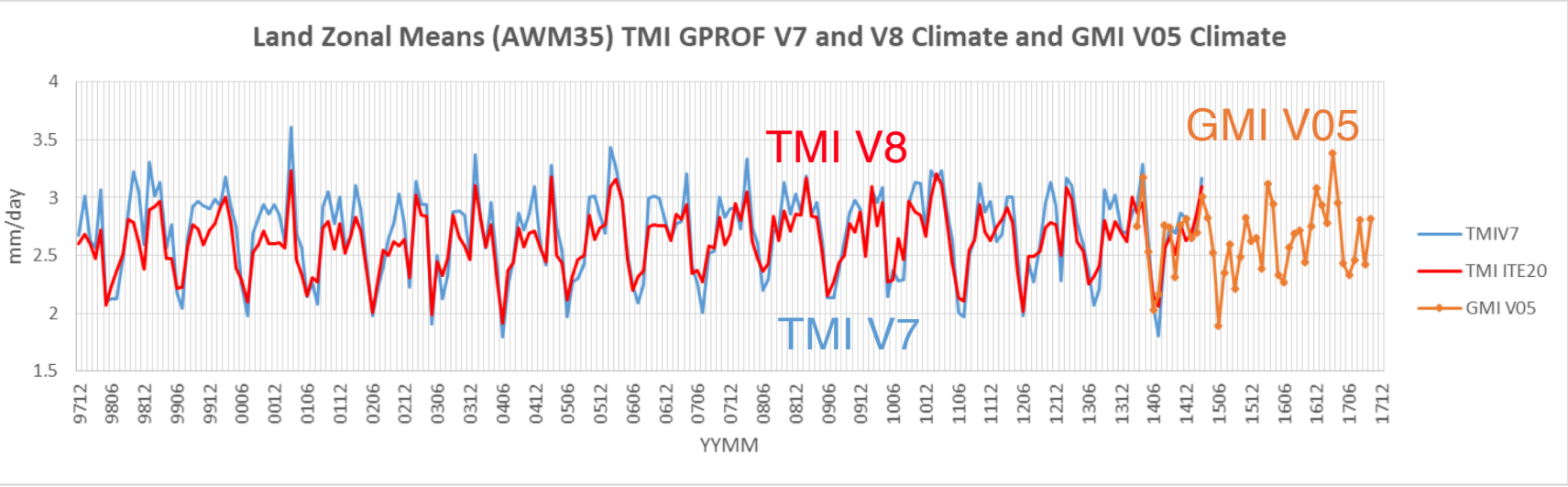
- GPROF retrieval adapted to the Colorado River Basin
- Two years of Multi-Sensor Multi-Radar (MRMS) precipitation data form the GPROF *a-priori* database
- Databases restricted to U.S. Mountain West region
- Two surface type bins: land without snow and land with snow
- Binned by surface type and 2-meter temperature
- Applies to GPM constellation conically scanning radiometers and cross-track sounders



Courtesy of C. Kummerow

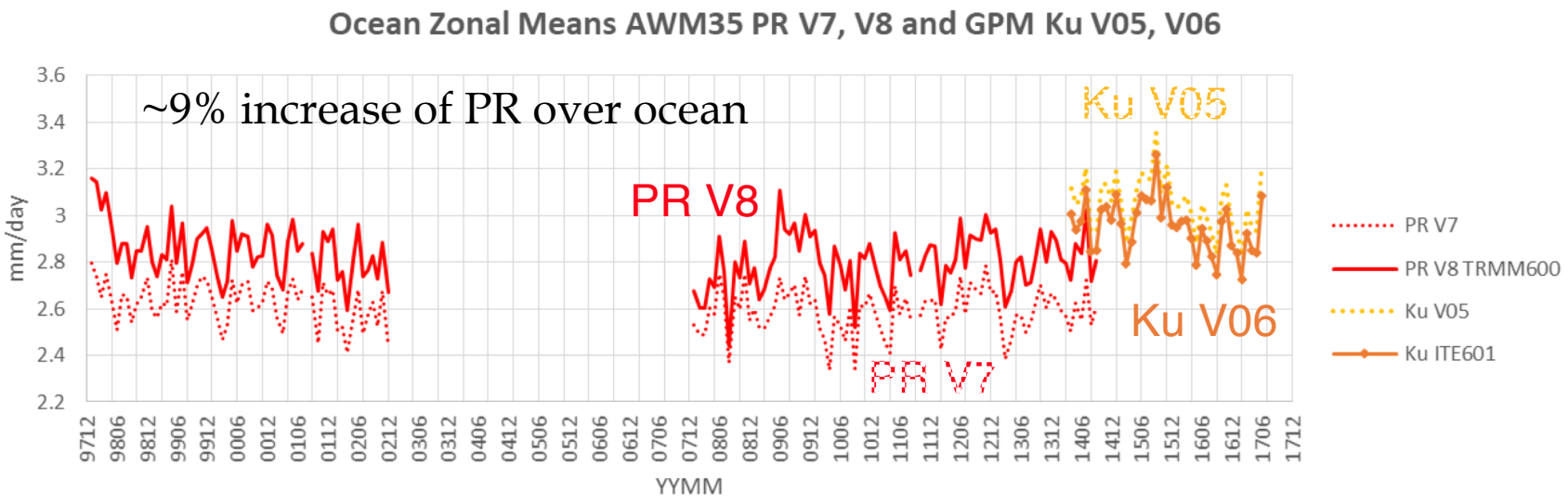
GPROF Time Series Of Global Mean

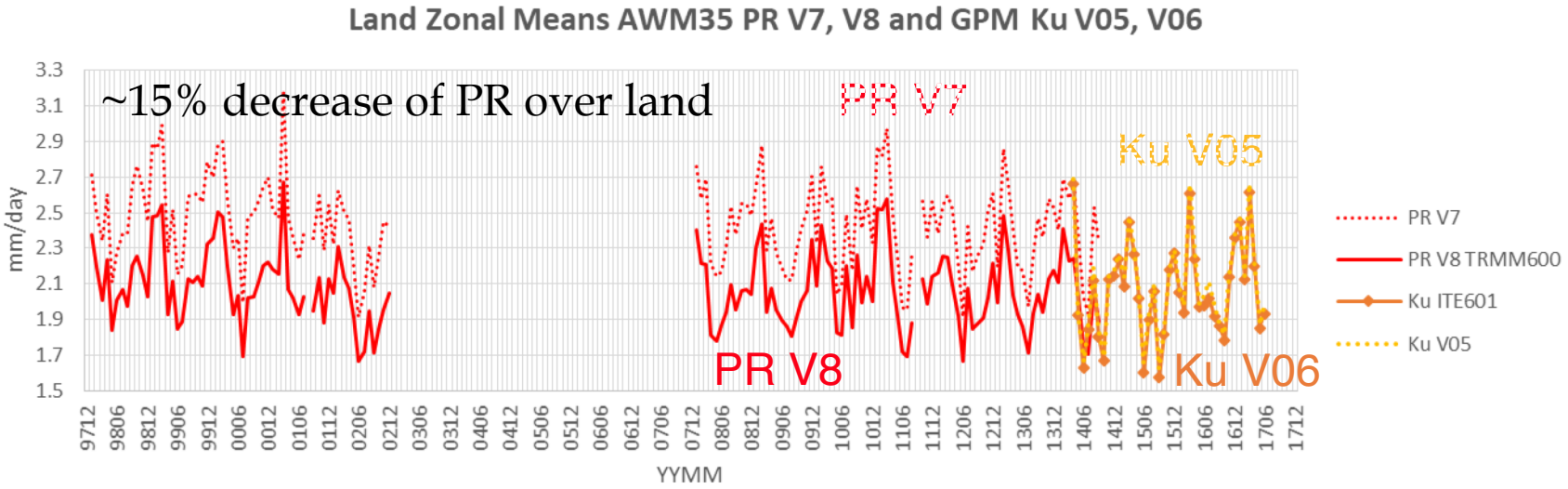




Images courtesy of John Kwiatkowski

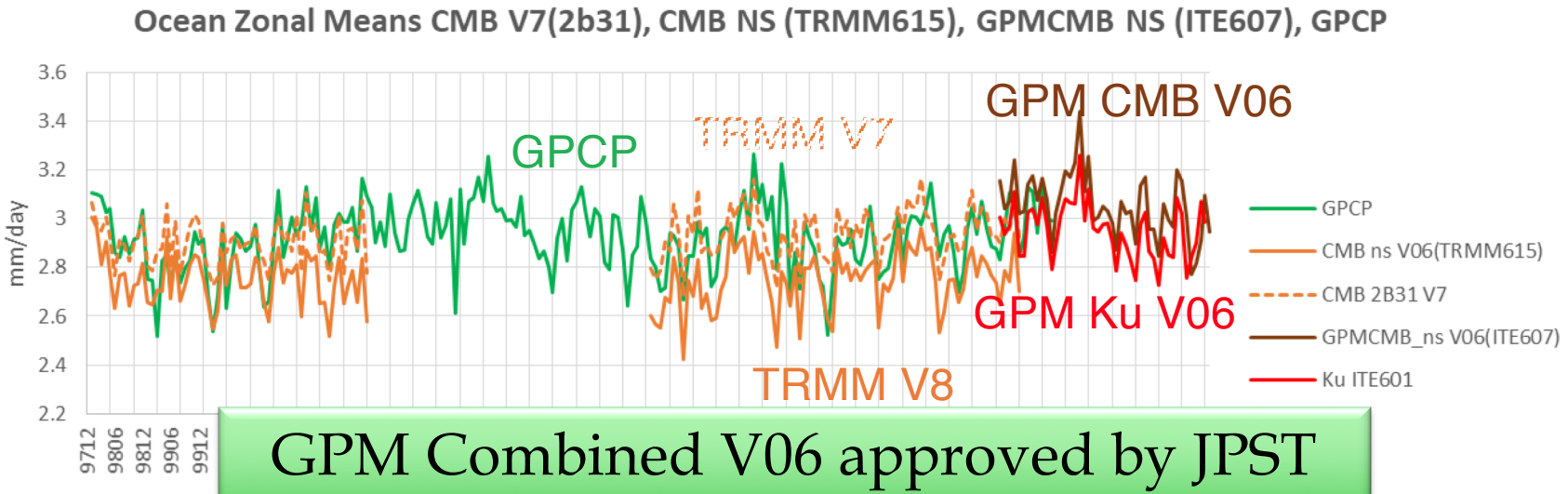
PR Time Series Of Global Mean



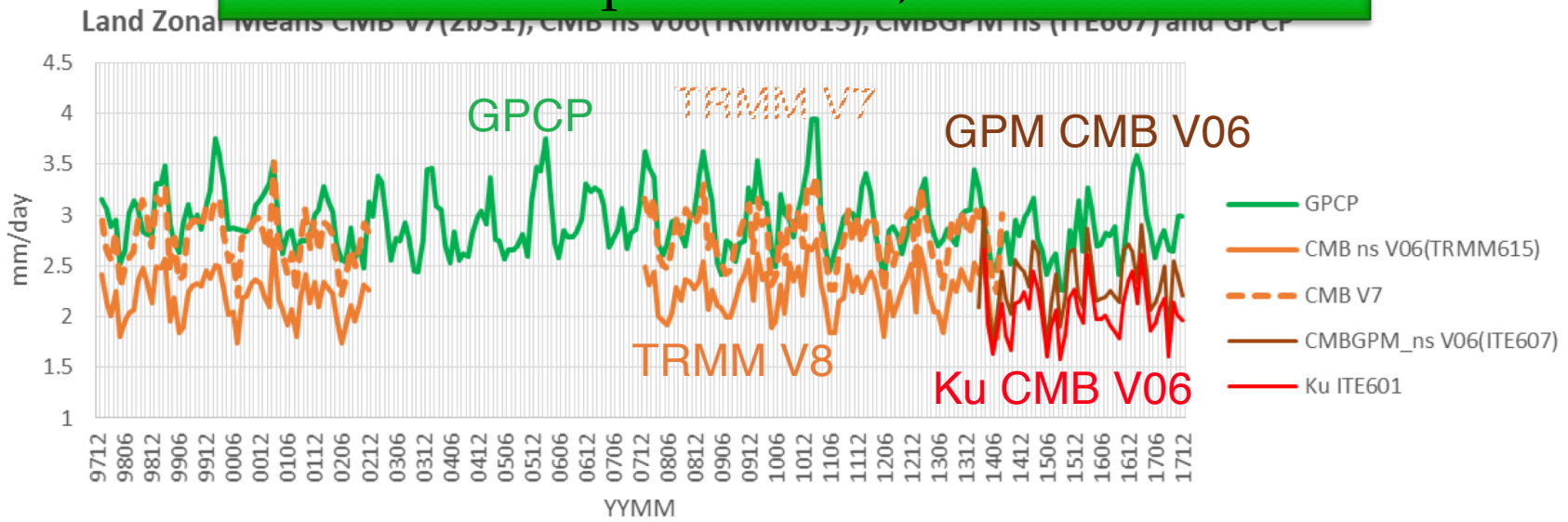


Images courtesy of John Kwiatkowski

Combined Algorithm Ocean and Land Time Series

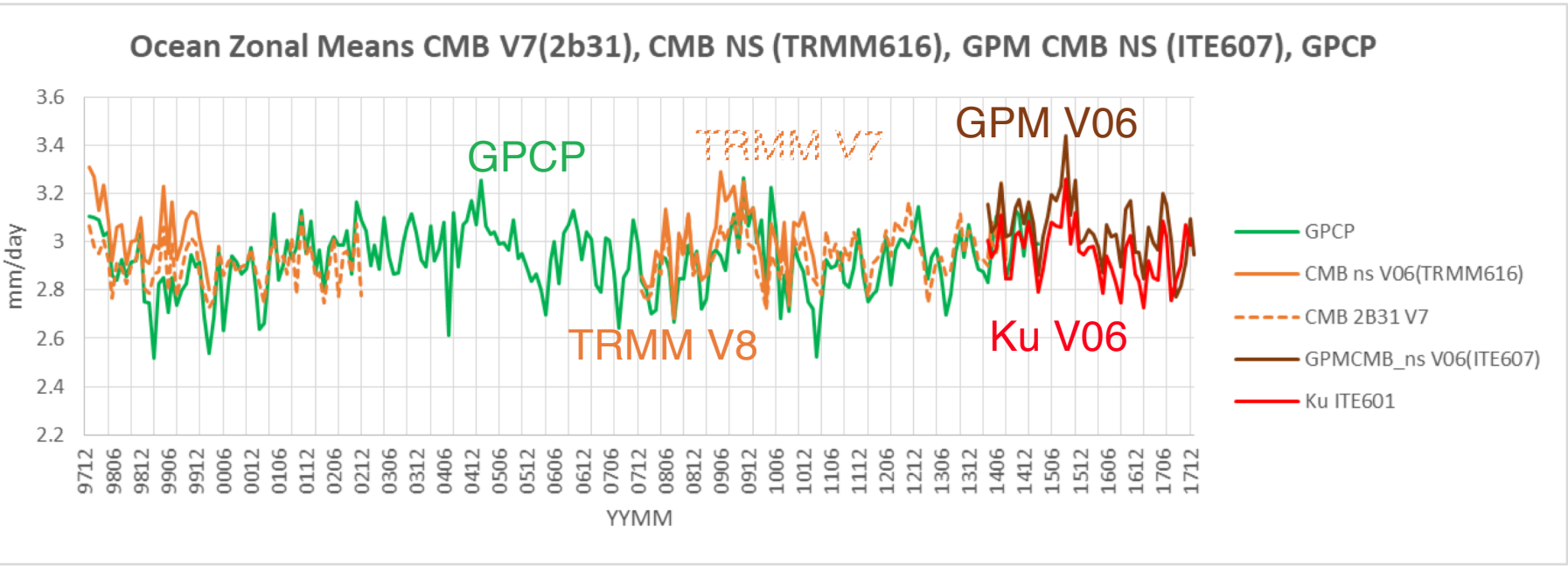


GPM Combined V06 approved by JPST September 21, 2018



Images courtesy of John Kwiatkowski

Combined Algorithm Ocean + Land Time Series



TRMM fix identified and implemented

TRMM Combined V06 (V8) approved by JPST yesterday

Image courtesy of John Kwiatkowski

Science Highlight

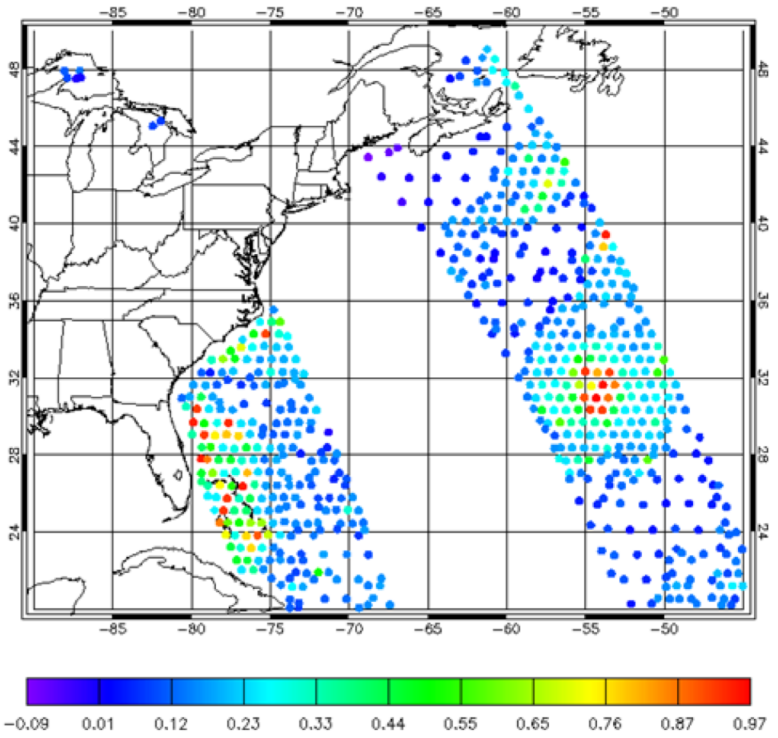
GMAO assimilation of all-sky GMI radiances in GEOS-5

Min-Jeong Kim (NASA GSFC GMAO)

All-Sky GPM Data in GEOS Weather Forecasts

- On 11 July 2018, the GMAO began assimilating GMI observations
  - Assimilation of GMI radiances in real-time
  - Active assimilation under all-sky situations
- Advanced methods were incorporated to optimize the use of these observations
  - Adaptive thinning in the presence of clouds and precipitation (left, where warm colors indicate increased convective activity)
  - Advances to underlying radiative transfer algorithm
  - Incorporations of cloud ice, cloud liquid, rain, and snow into the solution

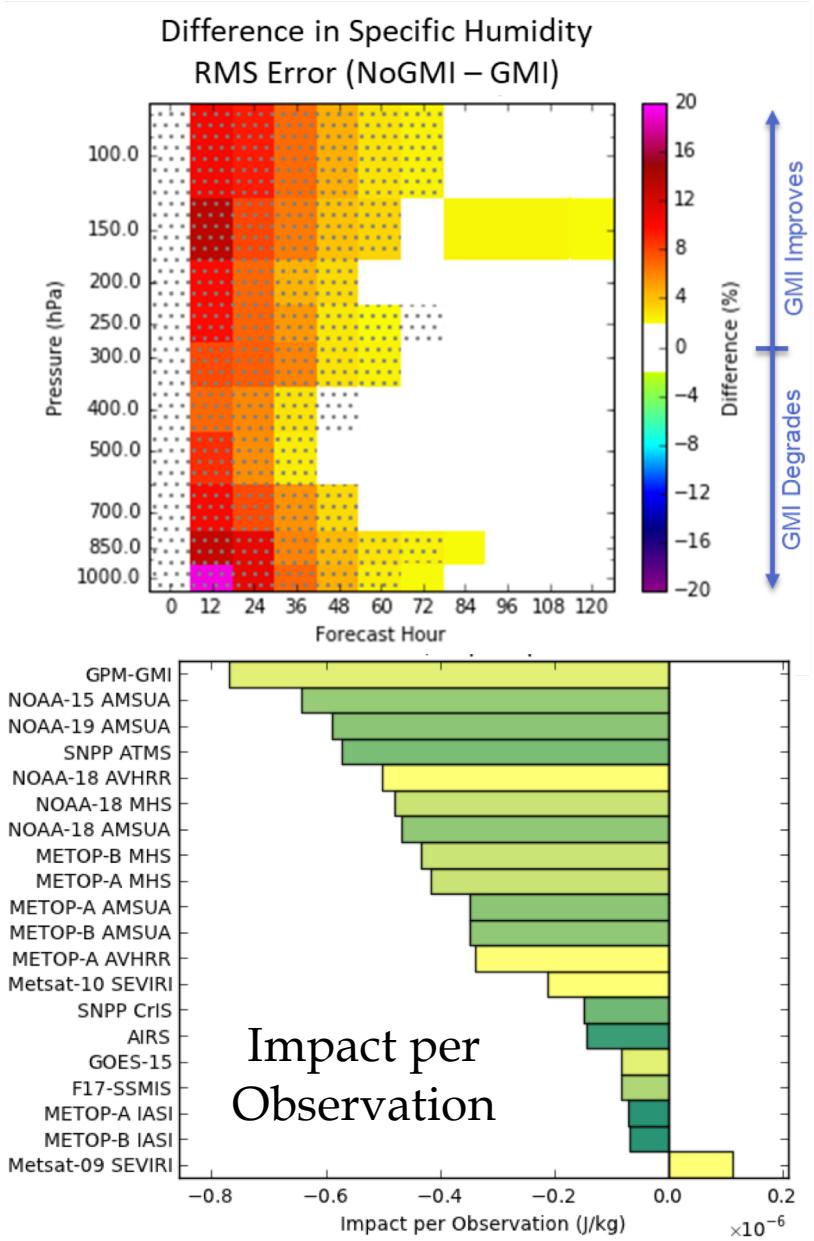
GMI Observations (1-Normalized 37 GHz TB polarization difference)



Min-Jeong Kim (GMAO/GESTAR)

All-Sky GPM Data in GEOS Weather Forecasts

- Largest impact of GMI radiances in the Tropics
  - Specific humidity improved in short term (0-72 hour) forecasts (top, hatched indicates significance)
  - Similar improvements occur in tropical mid and lower tropospheric temperature and winds (not shown)
- Other modeling and initialization improvements included in the GEOS upgrade extend these improvements into the medium range
- **GMI is seen to have the highest impact per observation of all the radiance observation types**, and the total impact of GMI (bottom) is comparable to a single Microwave Humidity Sounder instrument (not shown)



News from other precipitation-related missions:

- IMPACTS
- TROPICS
- TEMPEST-D
- Raincube

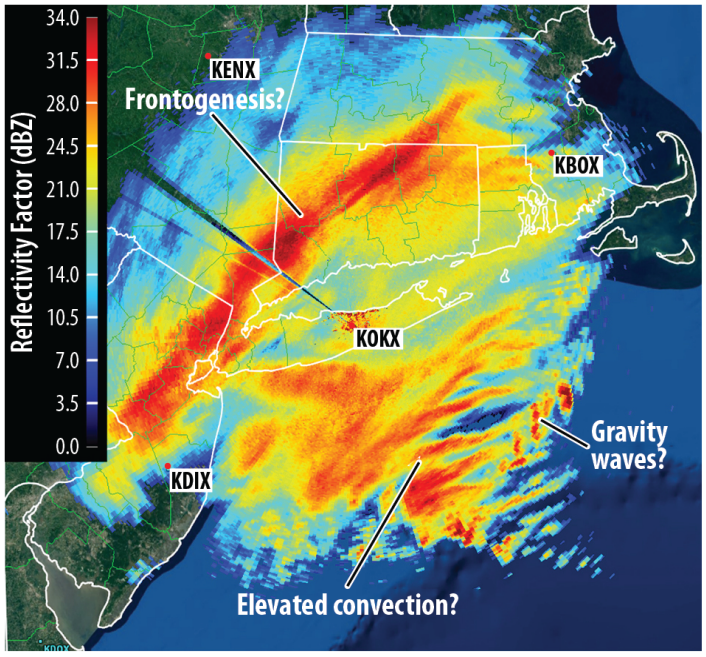
Earth Venture Suborbital-3 Selection

- Investigation of Microphysics and Precipitation or Atlantic Coast-Threatening Snowstorms (IMPACTS)
  - PI Lynn McMurdie, University of Washington, deputy PIs G. Heymsfield (GSFC) and S. Braun

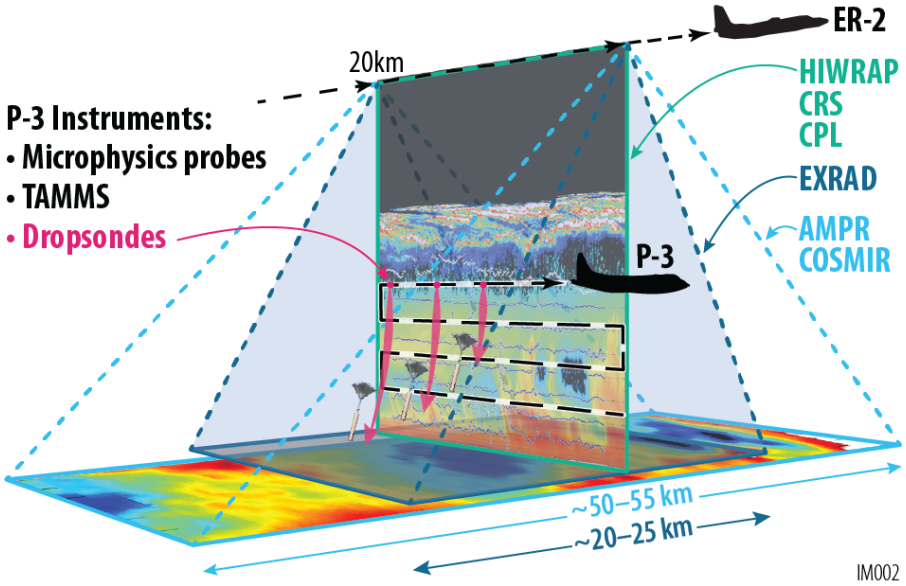
IMPACTS Objectives

1. **CHARACTERIZE** the spatial and temporal scales and structures of snow bands in Northeast US winter storms
2. **UNDERSTAND** the dynamical and microphysical processes that produce the observed structures
3. **APPLY** this understanding of the structures and underlying processes to improve remote sensing and modeling of snow

IM055



IM041



IM002

See poster 144 today!

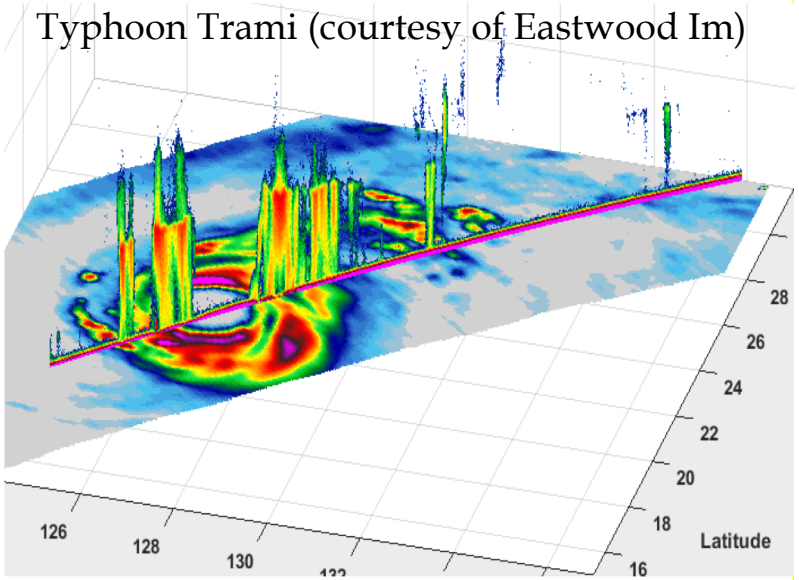
SmallSat Advancements Relevant To GPM

MicroMAS-2a (90-205 GHz) launched 1/11/18, MicroMAS-2b launch in Fall '18 TROPICS delivery in Fall '19

TEMPEST-D, 89-182 GHz, launched to ISS May 2018; turned on Sept. 20, 2018.

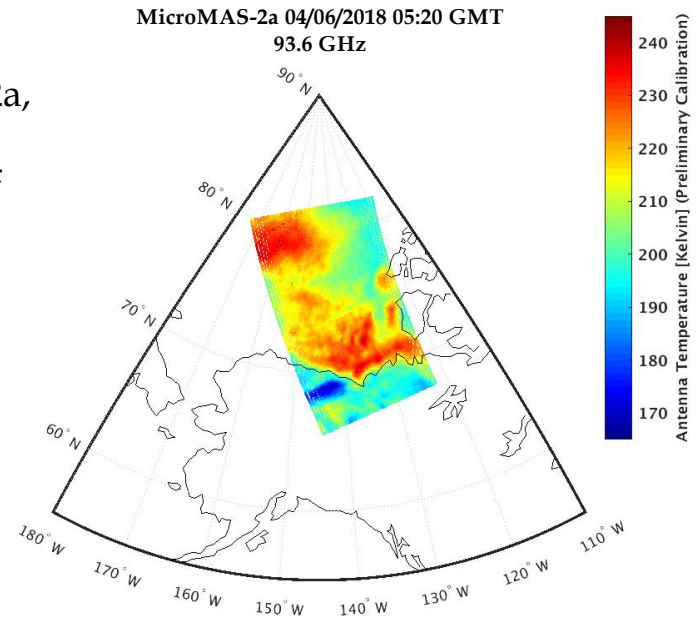
RainCube (Ka-band) launched May 2018, deployed on ISS July 2018

TEMPEST-D, RainCube data from Typhoon Trami (courtesy of Eastwood Im)

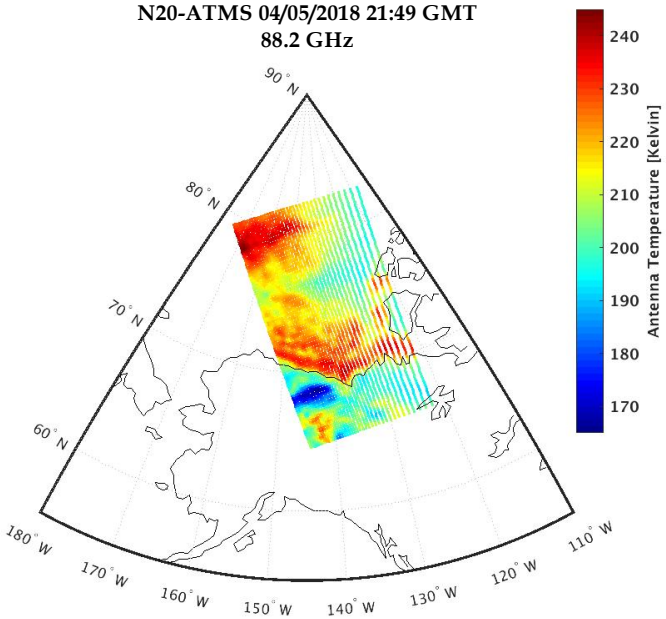


Micromas-2a, ATMS data (courtesy of William Blackwell)

MicroMAS-2a



N-20 ATMS



Reminder to Session Chairs

Please provide 2-4 bullet points of the key elements/areas of interest that were discussed or presented on during your session

Please send these via e-mail to dalia.kirschbaum@nasa.gov by the END OF THE MEETING

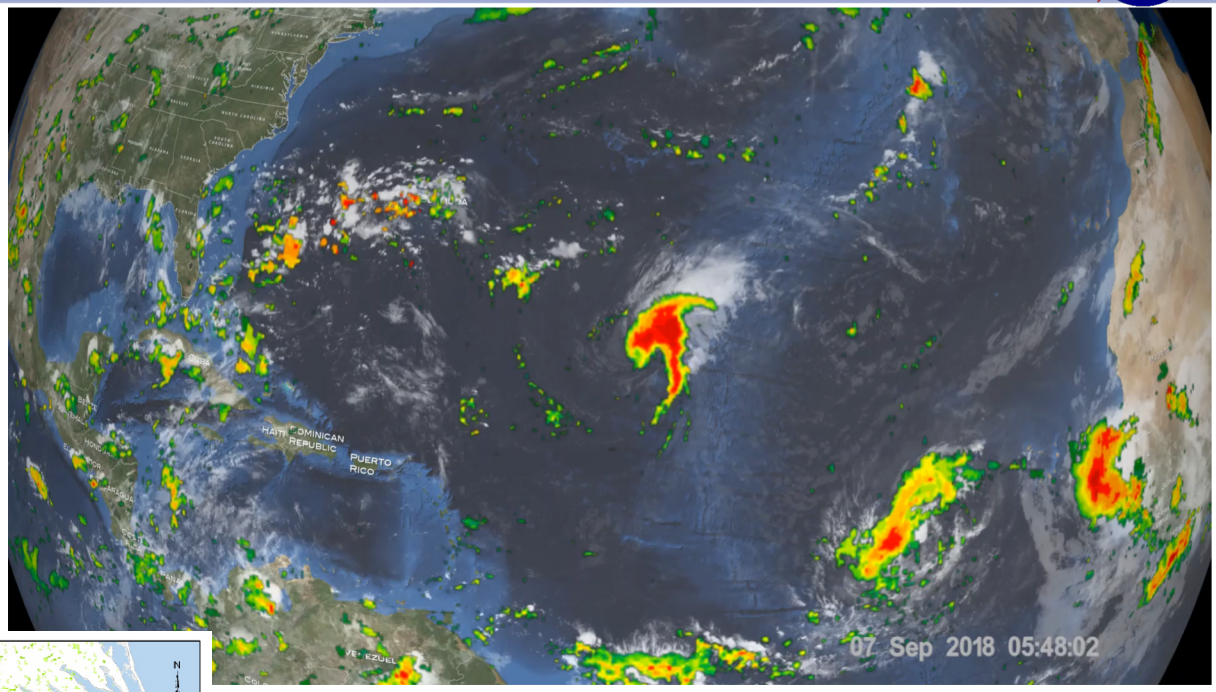
These will be used to prepare a NASA Earth Observer Meeting Summary

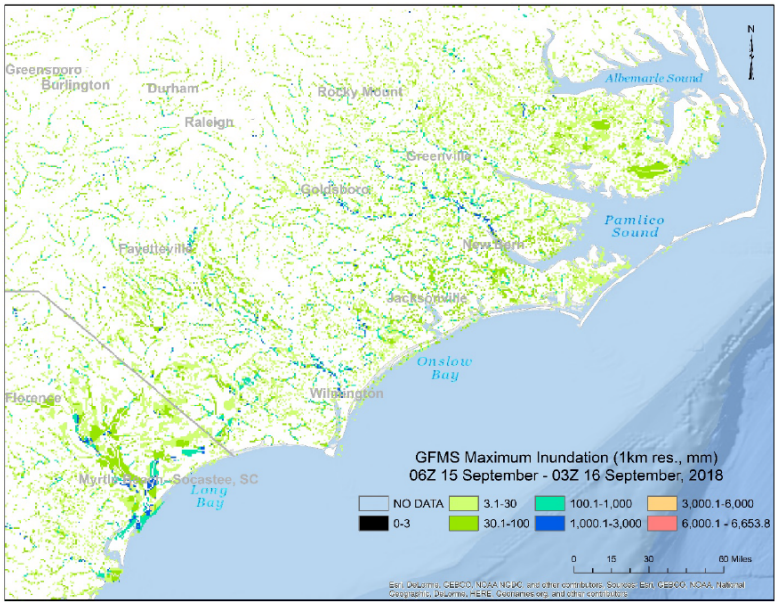
GPM Peer Reviewed Publications

- Please send accepted GPM related publications (in any journal) to Lisa Nalborczyk for inclusion on the GPM webpage listing
  - Currently at 261 publications (starting a few years prior to launch)
  - https://pmm.nasa.gov/resources/gpm-publications
  - Web of science search of GPM+precipitation suggests 301 publications since 2014
    - 2018 88
    - 2017 86
    - 2016 62
    - 2015 41
    - 2014 24

Hurricane Florence

Overpass of Hurricane Florence on Sept. 7th, 2018, prior to rapid intensification. A convective burst has generated a well-defined anvil in, or just below, the outflow layer.





Data from the Global Flood Monitoring System (R. Adler/UMD) was specifically requested and used by FEMA to improve understanding of potential flooded areas. This plot shows GFMS Maximum Inundation estimates on 9/16/2018.